

A PROACTIVE APPROACH TO REDUCING FIRE FIGHTER INJURIES

Strategic Analysis of Community Risk Reduction

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ABSTRACT

Palm Beach County Fire Rescue has many employee's who are suffering, or have suffered job related injuries and decreased performance levels on the fire ground and at other emergency incidents. This situation has had detrimental effects on the fire department, its employees, and the recipients of its services. The purpose of this research was to develop a proactive solution to employees suffering job related injuries and a decrease in stamina while performing emergency operations. This condition has had deleterious effects on Palm Beach County Fire Rescue and has become more serious as the average age of the department employee has increased. Through evaluative research, the following questions were researched and addressed:

1. Is there a direct correlation between a firefighter's level of physical fitness and job performance?
2. Is there a direct correlation to job related injuries and poor physical conditioning?
3. Does poor physical conditioning effect firefighter longevity?

Each year, the amount of data indicating that firefighting is among the most dangerous occupations increases. In addition, the amount of data

indicating that a program of physical fitness can significantly reduce the likelihood of death or injury is also growing. It should be apparent to Executive Fire Officers that through the implementation of an annual physical agility and health screening program, departments can enhance firefighter performance and improve their overall well being, along with providing fiscal efficiency. With each passing day more fire departments are beginning to realize that through a small investment of time and money in a physical fitness program, they will reap a return in the form of stronger and healthier firefighters, with a significant improvement in their performance level and work capacity, along with a reduction in sick leave and line of duty injuries.

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INTRODUCTION

Palm Beach County Fire Rescue has many employee's suffering from job related injuries, as well as decreased performance levels on the fire ground and at other emergency incidents. This situation has detrimental effects on the fire department, its employee's, and the recipients of its services. The purpose of this research project was to develop a proactive solution to employee's suffering job related injuries and a decrease in stamina while performing emergency operations at Palm Beach County Fire Rescue. Although the problem of job related injuries and poor stamina may be occurring in other areas of Palm Beach County Fire Rescue, this project only addresses the problems that affect the Operations Division. This project proposes to develop a program that will effectively resolve the deficiency of poor stamina and decrease the number of job related injuries among firefighters at Palm Beach County Fire Rescue.

The evaluative research methodology used suggests that through a program of physical fitness firefighters can significantly reduce the incidence of death and injury.

The specific research questions to be answered are:

1. Is there a direct correlation between a firefighter's level of physical fitness and job performance?
2. Is there a direct correlation to job related injuries and poor physical conditioning?
3. Does poor physical conditioning affect firefighter longevity?

BACKGROUND AND SIGNIFICANCE

Throughout the course work in the Strategic Analysis of Community Risk Reduction class it was stressed that leaders in the fire service need to identify at risk behaviors in their community. Once an at risk behavior is identified pertinent data should be analyzed and action taken to modify the at risk behavior. This is the case with the fitness level of firefighters at Palm Beach County Fire Rescue. The current performance related issue within Palm Beach County Fire Rescue system stems from problems never before addressed. In order to appreciate the complexity of the issues, one must develop a basic understanding of the fire/rescue service organization in Palm Beach County and its development.

Setting of the Problem

Palm Beach County Fire Rescue is the product of the October 1, 1984

consolidation of 10 separate fire control districts (fire departments) into one large fire and rescue department. Since that time, Palm Beach County Fire Rescue has been the primary provider of emergency services in the unincorporated areas of Palm Beach County. Palm Beach County Fire Rescue provides mitigation of emergency situations and a variety of other services to the public, in a cost-effective manner.

Services provided by Palm Beach County Fire Rescue include, but are not limited to, response to fire and medical emergencies, public education programs, plans review, inspections, investigations, and public service calls (Appendix a).

Palm Beach County Fire Rescue is segmented into three distinct divisions, each headed by a deputy chief, who reports directly to the fire-rescue administrator. The Operations Division is comprised of those individuals assigned to fire-rescue battalions, airport crash-rescue, special operations, trauma hawk and air operations, and training and safety. The Operations Division is the largest segment of the fire department, encompassing approximately 80% of the employee's and is responsible for responding to a wide array of emergencies. These emergencies include, but are not limited to, structure fires, building collapses, medical emergencies,

and hazardous materials incidents.

The Safety Services Division deals with code enforcement, plans review, investigations, and public education. The Support Services Division is responsible for emergency dispatch services, radio and telephone repair, fleet and facilities maintenance, budget and finance, planning and policy, payroll and personnel, and public information. Although the Safety Services and Support Services Divisions are vital to the operation of the fire department, they differ in the fact that they are responsible for the non-emergency aspects of the fire department. As such, the employees assigned to these divisions do not require the physical capacity required of those employees assigned to the operations division.

Palm Beach County Fire Rescue employs a total of 857 employees, of which 705 are shift (24 hour) personnel assigned to the operations division. Palm Beach County Fire Rescue consists of 31 full service fire stations that responded to more than 63,000 calls in 1997. These 31 stations cover approximately 583 square miles and are geographically located between Jupiter to the north and Boca Raton to the south.

History and Background of the Problem

For the past 13 years Palm Beach County Fire Rescue has been

actively engaged in providing emergency services to the residents of the unincorporated areas of Palm Beach County. Prior to the consolidation, emergency services were provided by 10 individual fire control districts. Palm Beach County Fire Rescue responds to many calls every year. For example, in 1997 there were more than 63,000. Many of these calls were both mentally and physically taxing for the individuals involved in mitigating the incidents. A large portion of the calls to which firefighters respond occur at dark or in the early morning hours, during inclement weather, and under a wide array of other unfavorable conditions. Oftentimes, possibly as a result of poor fitness coupled with extreme conditions, many firefighters sustain injuries while performing the arduous tasks involved in firefighting and rescue operations.

Firefighting is known to be one of the most physically and mentally demanding occupations today. Further, firefighting differs from virtually all other physically demanding jobs in that the emergency incident is the driving mechanism for setting the requirements of the job (United States Fire Administration, 1990).

Unlike many physically demanding jobs such as roofing or block masonry, in which workers adapt to a constant environment and a known level

of physical requirements, firefighters face a different set of physically demanding conditions at every emergency. In essence, no two emergency scenes are exactly alike. This requires firefighters to be both physically and mentally prepared to handle a myriad of circumstances. Technological advancements have reduced the physical effort required by many professions, but firefighting remains largely unchanged from practices utilized 30 years ago. Just as in years gone by, firefighters must still enter hostile environments to affect rescues and advance hoselines to extinguish fires.

However, there have been significant improvements in the personal protective gear that is both worn and used by firefighters today. Despite these improvements, the typical weight of a firefighter's protective gear continues to weigh approximately 50 pounds. This weight does not include any of the tools which are required for the firefighter to perform their job. Additionally, firefighters face heat, noise, poisonous gases, and emotional stressors on a daily basis.

Each year, over 50% of the firefighters who die in the line of duty succumb to heart failure and other stress related problems (Bey, 1992). Consequently, it is very important that Palm Beach County Fire Rescue's firefighters maintain a high level of physical fitness. Unfortunately, this has

not been the trend during the past 13 years. Rather, it appears that as the average age of the firefighters has increased, there has been a corresponding decrease in employee stamina while operating in emergency situations.

Most of Palm Beach County Fire Rescue's stations operate with at least one engine and one rescue vehicle. The department's minimum staffing requirements mandate that every engine must be staffed by three personnel: one officer, one driver, and at least one firefighter. In reference to the rescue units, the state regulates that every rescue unit must be staffed by a minimum of two personnel: at least one paramedic and one emergency medical technician (E.M.T.) (Palm Beach County Fire Rescue (PBCFR), 1996).

Although several of Palm Beach County Fire Rescue's stations operate with an Advanced Life Support engine (ALS), which is a combination rescue unit and fire truck, these stations are a minority within the department. ALS engines are staffed by at least three personnel: one officer, one paramedic, and one driver/E.M.T. (PBCFR, 1996). Additionally, there are some stations that have specialty units and tankers. Due to the fact that firefighting is a profession which requires a high degree of group cooperation, it is easy to comprehend how important the performance of each team member is to the overall operation.

Over the past 13 years Palm Beach County Fire Rescue has expended the majority of its operating budget on human resources. This is similar to other large metropolitan area departments. As an example, in fiscal year 1996-97 over 80% of Palm Beach County Fire Rescue's operating budget was expended on salaries and benefits of its employees (Palm Beach County Fire Rescue (PBCFR), 1997). However, this expenditure does not include any expenses for fitness programs or annual physical examinations. Another 3% of the operating budget has been spent on the purchase and maintenance of firefighting related equipment. Palm Beach County Fire Rescue has aggressively implemented a preventive maintenance program for the vehicles and equipment it has purchased during this same 13 year period. Unfortunately, during this same period, the department has failed to take into account the health and fitness of its most expensive resource, their employees. This is evidenced by the fact that the department has not instituted any type of routine fitness programs, mandatory annual physical examinations, or any specific level of fitness condition that employees must maintain.

LITERATURE REVIEW

A literature review was conducted at the National Fire Academy in Emmitsburg, Maryland. The purpose of this project was to explore and review research addressing the physical performance and physical fitness of firefighters. The literature review determines whether or not there is a direct correlation between a firefighter's level of physical fitness and job performance. The research will also probe the issue of job-related injuries as they relate to poor physical conditioning and firefighter longevity.

The Occupation of Firefighting

From a physical perspective, the act of firefighting closely resembles that of professional sports. In both cases, participants perform dangerous and difficult physical tasks to defeat an adversary. These tasks require extreme muscular strength, endurance, flexibility, and aerobic capacity (Rubin & Nugent, 1992). Prior to hiring new personnel, most fire departments require employment candidates to undergo a test of their physical fitness. These physical agility tests vary from department to department. Most simulate the physical ability necessary to perform firefighter duties by having the candidates climb ladders, lift and carry 125 pound sacks of sand, drag hoses, do pull-ups, and run a mile in a specific time frame (Nerhaugen, 1990). The

1964 Civil Rights Act, Title VII (1964) has a specific exemption that relates to firefighters as follows: “Every combat firefighter that responds and participates in firefighting must be able to meet the entry level requirements of the department.”

Once the candidates become employees of the fire department, they are put into a training class to undergo specific and intense training in all aspects of firefighting (PBCFR, 1997). During this training class, the employee may participate in a physical fitness program that includes aerobics, running, and weight training. Upon successful completion of the training class, the firefighters are assigned to a station where they will assume full firefighter duties. However, unless the department is one of the few that mandate a physical fitness program for all of its employees, the firefighter is responsible for maintaining his or her own physical fitness level (Williams, 1988).

While performing their job, firefighters are typically exposed to the following environmental conditions:

1. Temperature - Wind chill en route to the fire scene and prolonged exposure to cold during firefighting are major stress factors. Heat, always present at a fire scene, poses a more serious problem. Inside a burning

structure, temperatures can rise above 449.6F, far higher than firefighting protective gear can withstand. Protective equipment is designed to keep heat and fire away from the firefighter, but it also limits dissipation of body heat generated during physical work. This creates a secondary heat environment. Failure to provide proper hydration to the firefighter results in accelerated fatigue, heat exhaustion, or even heat stroke (Davis, Biersner, Barnard, Schamadan, 1982; Goldman, 1990; Rupp, 1986).

2. Noise - Research has been conducted to show that noise levels during firefighting continuously exceed the safe limits recommended by the Occupational Health and Safety Administration (Reischl, 1979). At some firefighting scenes, mechanical equipment generates such high levels of sound pressure that a serious need for noise abatement and hearing protection exists. Not only does exposure to high noise levels lead to hearing loss, but it can also lead to fatigue and adverse cardiovascular effects (Sanden, 1981).

3. Breathing Atmosphere - Numerous deadly gases, such as hydrogen cyanide, carbon monoxide, and phosgene, are routinely present at fires (Gold, 1978). The “mopping up” or overhaul portion of interior firefighting may be the most hazardous period of exposure for firefighters because carbon monoxide (a deadly gas) levels are extremely high and firefighters are more

likely to remove their protective breathing equipment during this time (Radford, 1976). Toxic levels of carboxyhemoglobin should be established with specific guidelines regarding when to remove the firefighter from the scene (Stewart & Stamm, 1976). Carbon monoxide is an occupational hazard among firefighters who fail to wear protective breathing equipment (Sammons & Coleman, 1974) or maintain a proper mask seal on their SCBA (Levine, 1979). Exposure to high levels of carbon monoxide has been demonstrated to cause increased incidence of pulmonary injuries and coronary artery disease. Firefighters who smoke cigarettes and are exposed to carbon monoxide are subject to a large decrease in pulmonary function (Hennessey, 1991; Kurt & Peters, 1975).

The physical demands of firefighting have led researchers to identify the maximum aerobic capacity (VO_{2max}) as one of the most important factors in the work performed by firefighters. Physical activity in a simulated environment required 12 times the energy needed during the resting state. Wearing protective equipment consisting of coat, boots, helmet, and SCBA, reduced a firefighter's work efficiency by 27% (Davis & Dotson, 1978; International Association of Fire Fighters, 1983; Rupp, 1986). It was noted that the weight of the mask (SCBA) was the most detrimental factor to work

capacity (Davis & Santa Maria, 1975). Fireground operations which included working with hoses required 60% to 80% of aerobic capacity (Lemon & Hermiston, 1977). Sudden physical activity in a firefighter has been shown to result in electrocardiogram (ECG) abnormalities in 70% of firefighters (Barnard, Gardner, & Diaco, 1973; Davis, Biersner et al., 1982). These cardiovascular effects may be multiplied by the presence of psychological or anticipatory stress (Barnard & Duncan, 1975).

Heat, noise, and poisonous gases are specific stressors in firefighting. The tasks performed by firefighters require superior strength and endurance. Coupled with environmental conditions, the physical stress of always having to be ready to go full speed at any given moment, to any given set of circumstances when the bell sounds, creates a physically and psychologically demanding work environment, where only the most mentally prepared and physically fit firefighters survive and perform to their optimum capacity (Davis et al., 1982).

There are many risk factors that can predict a person's chances of developing heart problems. The following risk factors are combined to estimate a firefighter's risk of developing heart disease and his or her responsibility for prevention.

1. Age - The fact remains that the risk of heart disease increases with age (Thomas, Cady, O'Connell, Bischoff, & Kershner, 1979).

Arteriosclerosis, a disease in which thickening, hardening, and loss of elasticity of the arterial walls, resulting in impaired blood circulation, grows progressively worse over time. There are no symptoms associated with arteriosclerosis in its initial stages and it most often goes undetected until a person reaches the age of 50 or 60 (Hennessey, 1991). In the near future, approximately 40% of the work force will be between 45 and 65 years old (Ilmarinen, 1991), and the mean age of professional firefighters is rapidly increasing (Ilmarinen, 1993). This trend will be heightened if the retirement age of firefighters is raised, or the mandatory retirement age policy is abolished (Lusa, Louhevaara, & Kinnunen, 1994).

Another factor to consider with the rising age of firefighters is the diminishment of their cardiovascular fitness. There is concern that advancing age is typically characterized by a diminished ability to perform, safely and effectively, the physically strenuous fire suppression tasks required of firefighters on a daily basis (Saupe, Sothman, & Jasenof, 1991).

It has been argued that individual variability does exist in regards to diminished cardiovascular fitness with advancing chronological age.

However, it is well known that maximal oxygen consumption (VO₂max) is a direct indicator of a firefighter's cardiovascular status and his ability to sustain dynamic physical work. VO₂max is directly linked to a firefighter's level of fitness (Pandolf, Burse, & Goldman, 1977).

Performance of fire suppression tasks is enhanced in those individuals with high VO₂max (Adams et al., 1986). Accordingly, there have been reports published that recommend requiring a specific level of VO₂max for firefighters. However, given the existing legal controversies pertaining to adverse impact, departments would have to present considerable justification for any proposed level or standard of VO₂max, which would involve costly research and litigation (Shephard, 1987). It is logical to assume that firefighting may impose a greater demand on the older firefighter and additional decrements in performance may occur if the older firefighter's level of physical fitness is below average (Davis, Dotson, & Santa Maria, 1982).

2. Gender - Medical surveys show that men have a higher rate of coronary heart disease than women. Since the majority of active firefighters are male, it is evident that most firefighters are at risk (Hennessey, 1991).

3. Heredity - Heart disease is known to run in families. If close family members (parents, grandparents, aunts and uncles) were victims of angina (chest pain resulting from decreased coronary blood flow) or heart attack during their forties, a member of that family will be at a higher risk of developing the same problems (Hennessey, 1991).

4. High Blood Pressure - The risk of heart disease is higher in individuals who have high resting systolic blood pressure. Hypertension is associated with a higher level of coronary heart disease, congestive heart failure, and stroke. Reduction of blood pressure through a treatment program and/or drug therapy has been shown to be effective against cardiovascular disease. However, any effective treatment program for hypertension must include changes in diet and lifestyle; i.e., weight loss and regular exercise, regardless of whether or not drug therapy is needed (Hennessey, 1991).

5. Blood Cholesterol Levels - The higher the blood cholesterol level, the greater the risk of coronary heart disease. There have been several studies and various opinions discussing the desirable cholesterol level and how it affects human health. It is medically recognized that as blood cholesterol levels decrease, the risk of developing arteriosclerosis decreases as well (Hennessey, 1991).

6. Obesity/Body Fat - The likelihood of heart disease increases with the amount of excess fat (Thomas et al., 1979). Obesity is defined as a 20% excess over a person's ideal body weight, for which there are established tables for measurement. It is estimated that over 30% of Americans in the general population are obese, so it is safe to assume this percentage is also probably true for the fire service. Being overweight alone does not contribute to heart disease, but it does increase hypertension (high blood pressure) and elevate blood cholesterol levels which are contributing factors to the risk for heart disease (Hennessey, 1991).

The amount of adipose tissue (fat) that is carried around by an individual has a profound impact on his or her physical ability to function. Body fat is of two types: essential fat that is stored internally, and non-essential fat from excessive caloric consumption that is stored under the skin. Fat is metabolically inactive, therefore, it adds considerably to the load carried by the musculature of the body and subsequently impedes performance on tasks such as sustained walking or load carrying. The general population erroneously accepts the notion that an individual's weight should increase with advancing years. No physiological basis for this exists aside from the fact that the general pattern in North America for adults is to

become more sedentary with advancing years (Davis & Dotson, 1987).

Body fat has been repeatedly shown to be important in physical performance. According to a study conducted by Davis and Starck (1980) at the Institute of Human Performance in Fairfax, Virginia, it has been shown that excess body fat is a culprit in the regression of firefighter performance. Excess body fat does not confer a strength advantage. In fact, excess body fat has the same debilitating effect on performance as does carrying unnecessarily heavy equipment. Increasing amounts of fat explain the loss of performance on aerobic capacity and other measures of muscular fitness better than age alone (Davis & Starck, 1980). Since body fat is controllable, it is reasonable to expect that the implementation of some body fat control requirement would significantly aid departments in providing fit firefighters (Davis & Dotson, 1987).

7. Smoking - In 1979, the U.S. Surgeon General reaffirmed the fact that cigarette smoking is dangerous to one's health (Hennessey, 1991). Repeatedly, the American Heart Association has stated that cigarette smoking is a leading cause of heart disease (Hennessey, 1991). Nonetheless, people continue to smoke. As the number of cigarettes smoked by an individual increases, so does the risk for heart disease (Thomas et al., 1979).

Due to the high rate of cardiopulmonary disease in the fire service, caused by exposure to harmful substances on the job, many fire departments have established a “no-smoking” policy for employees both on and off duty. In some states, cardiopulmonary diseases in firefighters are now considered to be job-related injuries.

According to the International Association of Fire Fighters (IAFF), there is legislation in 39 states that guarantees that if a firefighter is diagnosed with heart or lung disease, he/she can retire with disability benefits in compliance with applicable workers’ compensation laws. Therefore, if a firefighter develops a cardiopulmonary problem, it is considered a job-related disability and the firefighter will be compensated. Consequently, heart disease represents an expensive obligation for local/municipal governments. It is a matter of good business and common sense for fire department management to attempt to foster good health for firefighters (Hennessey, 1991).

There is significant research showing that if a person quits smoking, the damage is reversible. For those who stop smoking, the risk of heart attack drops by 50% after two years. Further, after 10 years, research has shown that ex-smokers decrease their chances of lung damage significantly and have

about the same risk level as those who have never smoked (Hennessey, 1991).

8. Stress - There is evidence that stress and personality type are health risk factors. Numerous experts cite the beneficial effects of exercise as a coping mechanism and release for stress (Facklemann, 1991).

While it is true that everyone encounters stress on a daily basis, firefighters face the same stressors as other people in daily life, and then must deal with five additional sources of stress associated with the fire service:

1. Level of uncertainty - Firefighters have little control over what will happen during their shift, nor can they plan what they will be doing during their on-duty hours.

2. Physical response to the alarm - As soon as the alarm sounds, the firefighter's body prepares for "battle." This results in a rise in blood pressure, increased sugar levels, increased adrenaline, and heightened muscle tension. Much of this high tension can be worked off if a working fire is encountered. However, false alarms produce little physical activity, and it may take the body hours to return to normal.

3. Interpersonal tension - The crisis nature of firefighting increases the tension between people--tensions that would have far less serious consequences in a non-firefighting environment. Poor communication, faulty equipment, or lack of coordinated effort can be fatal on the fireground.

4. Exposure to human tragedy - A high cost that firefighters pay for protecting the public is witnessing people losing their homes, businesses, and families. Firefighters frequently witness tremendous pain and suffering which exceeds their ability to mitigate.

5. Fear - Firefighters have concerns for their own safety and for the safety of fellow firefighters. The knowledge that their mistakes may result in serious injury or death is a tremendous burden (Ohio Fire Academy, 1990).

9. Exercise - Reduced risk of coronary heart disease is one of the most important benefits of regular occupational and/or recreational physical exercise (Allison, 1991). Exercise that significantly increases continuous blood flow through the heart, lungs, and large muscles is of most benefit. There is strong statistical evidence that a person's risk of heart attack decreases with participation in aerobic exercise and/or strenuous sports. Aerobic exercise strengthens the heart muscle by increasing the heart rate to the proper conditioning rate and steadily supplies oxygen to active muscles

for the duration of the exercise.

As the heart strengthens through months of exercise, it also undergoes other changes that provide extra measures of safety against heart attack. These changes include developing a stronger heart muscle with improved efficiency to pump blood to the body more quickly, and boosted circulation with an improved ability to process oxygen within a given time (Hennessey, 1991).

10. Diet - Everyone, including firefighters, should watch how and what they eat. A wholesome, well-balanced meal provides the necessary fuel to enable the body to perform at its optimal capacity. Low-fat and low cholesterol foods are recommended to keep fat, cholesterol, and blood pressure levels under control. At the fire station it can be difficult to eat nutritious meals because of routine interruptions and the fashion in which people are fed. All too often, take-out food is ordered and consumed hastily. Meals should be planned and prepared that contribute to a healthy diet (Hennessey, 1991).

Uncontrollable risk factors used to forecast the chances for developing heart problems such as age, gender, and heredity are unalterable. However, risk factors such as smoking, high blood pressure, obesity, blood

cholesterol levels, stress, exercise, and diet are under the direct control of each individual. By adjusting work habits and lifestyle, firefighters can significantly reduce cardiac related fatalities in the fire service. The fire chief has an obligation to the citizens of his jurisdiction to evaluate himself of herself, co-workers, and subordinates to reduce and/or eliminate all risk factors negatively affecting the physical performance level of the personnel in the fire department. Detailed medical evaluations throughout the course of a firefighter's career and implementation of physical fitness and dietary requirements are necessary to reduce the incidence of heart attacks among firefighters (Hennessey, 1991).

Physical Fitness in the Fire Service

The NFPA has proposed an improved *Standard on Medical Requirements* for firefighters known as NFPA 1582. This standard identifies firefighter functions that members are expected to perform at emergency scenes. This proposed standard is intent on making the nation's firefighters physically and mentally fit (Rubin & Nugent, 1992).

One fire department that became more aware of the importance of health maintenance to improve the relationship between firefighters and their department is the Phoenix Fire Department in Arizona. The Phoenix Fire

Department employs 1,100 members who operate out of 40 stations. In 1986, the department responded to 25,281 fire calls, 63,909 EMS calls, and 868 miscellaneous calls. Labor and management committees in the fire department identified health program areas that needed improvement. The program targeted problem areas including medical health monitoring, physical fitness evaluations, strength training programs, nutrition, health education, stress management, and environmental protection (Healy, 1988).

The department contracted the full-time service of a physician certified in cardiology, internal medicine, toxicology, and who was qualified as an occupational health specialist for a fire department. The first priority was to revise the department's annual physical examination. It is now standard for each firefighter to receive a medical examination in which his weight, height, pulse, blood pressure, temperature, and the health of his eyes and ears are evaluated. The exam also includes a complete SMA 20 blood test and a stress treadmill. A health clinic was established with a full line of diagnostic apparatus to conduct physical exams. A computer software program was developed to maintain basic medical records, track testing and dispatch the fire department physician to respond to major incidents and monitor the condition of the firefighters. Company officers were instructed to conduct at

least 1-1/2 hours of physical training per shift, with approximately 70% of members participating (Healy, 1988).

One benefit has been the significant decrease in the average percentage of body fat in firefighters. While the number of injuries among firefighters has not decreased significantly, the severity of injuries has lessened. The department's injury payout decreased even through there was a 10% increase in personnel and a 15% increase in emergency responses (Healy, 1988).

Likewise, in 1988, firefighters from the Hazel Crest Fire Department in Illinois began participation in a fitness program. Firefighters were required to perform a prescribed program of exercise three times a week for 30 to 45 minutes. Once a month, the firefighters were required to attend an exercise session during which their pulse and blood pressure were checked before and during exercise. The firefighters were told how they were progressing and their exercise programs were adjusted every 4 weeks as conditioning improved (Berk & Crumrine, 1990).

At the conclusion of the first year, significant results were achieved. Improvements were recorded in cardiovascular endurance, body fat composition, flexibility, blood pressure levels, and weight loss maintenance.

Since the inception of the fitness program, the department has reviewed it and implemented improvements by establishing a training site and adding medical monitoring equipment (Berk & Crumrine, 1990).

Participation in the department fitness program is considered a condition of employment for all safety members of the Ontario Fire Department in California (Davis, 1992). The program is called a “full-participation program” rather than a mandatory one, because everyone, including the chief, has to participate in the group effort. According to Chief Buhs of the Orlando Park Fire Protection District in Illinois, the most beneficial aspect of their fitness program is healthier firefighters who weigh less, are more flexible, and are stronger. The department therefore saves money on workers’ compensation, sick time, and early retirement (Skinner, 1992).

Fitness plays a key role in negating the damaging effects of heat, smoke, and stress. It decreases the chance of serious injury and decreases fatigue, while increasing self-esteem and confidence. If these are not good reasons to have a fitness program, the economics should be considered. The cost of medical care for injured firefighters, disability payments, lost time at work, and lower quality of work from less fit firefighters can easily outweigh

the cost of developing a fitness program.

The St. Louis Fire Department in Missouri began tracking injuries after the implementation of a fitness program. It was found that firefighters were sustaining fewer and less severe injuries. The fitness program of the Wichita Fire Department in Kansas has seen monetary benefits along with healthier firefighters. The reduction in sick leave utilization represented a savings of over \$250,000 in a department with 347 firefighters for 3 years concurrently (Bey, 1992).

When inspecting causes for premature retirement in the fire service, overwhelmingly retirements are caused by personal lifestyle behaviors that are controllable (Davis, 1991). Fitness programs do not cost--they pay. A large part of fire-related costs to the nation are in premature retirement of firefighter personnel. Unfortunately, this burden is passed onto the taxpayer through increased taxes.

If fitness programs benefit all concerned; municipalities, administration, and personnel; why are they so difficult to implement and maintain (Jaffe, 1989)? The employer's right to establish fitness standards for firefighters has been clearly established by the courts. The employer can choose to negotiate fitness standards with organized labor unions, to which

the majority of paid firefighters belong. If the choice is not to negotiate, the employer retains the right to set standards and develop procedures for testing and measuring fitness. However, once the standards and procedures are set, the employer can be required to bargain with the firefighter's union regarding the impact such standards have on employees. That is to say, the employer would not have to negotiate the substance of the standards, but would have to negotiate the effects of the standards on working conditions. This may require remedial help, duty time for fitness, or subsidized membership fees to fitness facilities. Litigation that may accompany implementation of fitness programs should not obscure the value and necessity of these programs to the firefighter, the fire department, and the community (Williams, 1988).

Fitness programs that are effective improve physical stamina and strength, reduce cardiovascular risk and disease, and decrease absenteeism and disability insurance claims. Added benefits include heightened job satisfaction, boosted morale, diminished job stress, and demonstrated fiscal savings (Jaffe, 1989). A fitness program should be presented in such a way that all firefighters are willing to participate. Mandatory fitness programs greatly increase both the degree of participation and the overall fitness level. Providing exercise equipment and incentives for fire service personnel

increases the degree of participation in a fitness program (Skinner, 1992).

Improving endurance and job performance of firefighters is the direct result of a successful fitness program. These benefits greatly reduce potential injury, early retirement, and death to firefighters. It is the fire chief's responsibility to ensure that personnel are in the best possible shape to provide protection to the public without personal injury (Hennessey, 1991).

PROCEDURES

The purpose of this research project is to develop a proactive solution to the problem of increased job related injuries and decreased stamina at emergency operations with Palm Beach County Fire Rescue. Poor health and fitness appears to impact all segments of a fire department organization. However, for this project, research was limited to the health and fitness issues of line firefighting personnel.

The first step in this applied research project was to identify to what extent the problem exists at Palm Beach County Fire Rescue by gathering data relevant to the departments personnel injury history. Once complete, a literature review for the paper was conducted at the Learning Research Center at the National Emergency Training Center. Evaluative research methods were

used to identify a specific problem statement. The areas explored include:

1. Is there a direct correlation between a firefighter's level of physical fitness and job performance?
2. Is there a direct correlation to job related injuries and poor physical conditioning?
3. Does poor physical conditioning affect firefighter longevity?

RESULTS

Through evaluative research, this applied research project discovered that firefighter fitness levels directly impact their ability to carry out fire suppression tasks (Davis, 1994). Furthermore, it discovered that there is a direct correlation between job related injuries and poor conditioning.

The job of firefighting requires both excellent physical and mental capacities. Physical demands are especially rigid during work inside a building that is on fire. Moving around inside homes and buildings that are on fire, while also handling heavy equipment or carrying injured persons, imposes severe demands on a firefighter's respiratory and circulatory organs and muscular strength. The circulatory organs are subjected to additional loading as a result of high internal and external heat production, which in

extreme cases may be severe enough to cause a firefighter to collapse (Kilbom, 1980).

Firefighters must have the strength and endurance to use their equipment effectively for long periods of time, along with the ability to recover quickly after each task they perform. Firefighters have to be able to push, pull, lift, and carry the tools of firefighting while wearing their business dress--50 pounds of turnout gear and self-contained breathing apparatus (SCBA) (O'Connor, 1994). The turnout gear is designed to withstand the heat of the fire, but it also traps body heat generated by the muscular work being done. This clothing is bulky, restricts movement, and increases the effort required to perform the necessary work. The SCBA apparatus worn on his or her back places the single most imposing limitation on a firefighter's performance (Gilman & Davis, 1993).

The physical demands of firefighting are very challenging. It is difficult to drag approximately 50 pounds of equipment while climbing ladders or running up stairs with a hose. Firefighters must also be capable of performing the most difficult and critical task of rescuing comatose victims who may weight as much as 200 pounds (Gilman & Davis, 1993). Firefighters perform heavy physical labor under extreme environmental conditions

(Lemon & Hermiston, 1977).

Finally, this project discovered that poor physical conditioning has a direct effect on firefighter longevity. There is little argument about the fact that no matter how well firefighters are protected by their turnout gear, if these same firefighters are not physically fit, they are in as much danger on the fireground as if they had run into a burning building without SCBA. As a whole, the fire service has spent millions of dollars over the past 20 years providing better protective equipment for firefighters, which has saved hundreds of lives and prevented numerous injuries. However, this work has scarcely put a dent in the leading cause of firefighter fatalities--heart attacks (Hennessey, 1991).

According to the National Fire Protection Association (NFPA), in 1989, 25% of fire service heart attack victims were under the age of 40 (Hennessey, 1991). Firefighters have suffered cardiac arrests while operating fire apparatus, while at the fire scene, and while off-duty. The largest portion of fatal heart attacks that occurred while a firefighter was at work, 46.6%, occurred during fire scene activities. Imagine the confusion and stress experienced by other firefighters on the scene when one of their own is incapacitated. The remaining heart attacks fell into the following categories:

25.1% involving firefighters responding to or returning from alarms, 10.4% during administrative and normal station duties, 8.4% during training, 5.9% while working at non-fire incidents such as emergency medical and rescue calls, and 3.6% during other on-duty activities like fire prevention, inspection, and maintenance (Fahy, 1993). Additionally, a recent NFPA analysis of firefighter deaths showed that from 1981 through 1990, 560 firefighters, or almost half the total number of firefighters who died while on duty during that period, died as a result of heart attacks (Fahy, 1993).

Increased awareness of the need for physical fitness improvement and maintenance programs inspired the NFPA to develop fitness standards for the entire fire service. Unfortunately, these NFPA standards are only voluntary guidelines, and are not required under law. NFPA 1500 states that all fire departments should have fitness programs that require departments to develop and maintain appropriate fitness levels (Bey, 1992).

Each year, over 100 firefighters are killed in the line-of-duty and over 100,000 firefighters suffer injuries ranging from minor sprains and strains to broken bones and career ending injuries. Research in this area strongly suggests that such injuries would be reduced if levels of fitness for firefighters were improved (Washburn, LeBlanc, & Fahy, 1990).

On the fireground performance is everything--the job is 90% physical. The fact that a firefighter tried really hard but failed to get the job done is of very little consolation to the family who has just lost a home, or worse, a loved one, to the ravages of fire. As professionals, it is every firefighter's responsibility to ensure that he or she has the physical capacity to execute the demanding tasks that are required to be safe and successful at the fire scene. There is no room for excuse or compromise when the job of firefighting needs to be done (O'Connor, 1994).

Once a firefighter arrives on the fire scene, physical fitness plays a critical role. Fitness is relevant to the overall success of the department's mission, for without this basic building block, firefighting efforts are seriously impeded. Physical effort, not technology, is required to get the job done expeditiously. Ascending levels of fitness correspond directly with increased fire suppression capacity. Studies questioning the relationship between task accomplishment and fitness have demonstrated that a physically fit person can accomplish the same task in as little as one-third the time it takes an out-of-shape person. As every firefighter knows, time is of the essence (Davis, 1994). There is little doubt that a wellness program would be beneficial to Palm Beach County Fire Rescue.

DISCUSSION

From a physical perspective, the act of firefighting closely resembles that of professional sports. In both cases, participants perform dangerous and difficult tasks to defeat an adversary. These tasks require extreme muscular strength, endurance, flexibility, and aerobic capacity (Rubin & Nugent 1992).

Prior to hiring new personnel, most fire departments require employment candidates to undergo a test of their physical fitness. These physical agility tests vary from department to department. The job of firefighting requires both excellent physical and mental capacities. Physical demands are especially rigid during work inside a building that is on fire. Moving around inside dwellings that are on fire, while also handling heavy equipment or carrying injured persons, imposes severe demands on a firefighters circulatory and respiratory organs and on their muscular strength (Kilbom, 1980). Firefighters have to be able to push, pull, lift, and carry the tools of firefighting while wearing their business dress--50 pounds of turnout gear and self-contained breathing apparatus (SCBA) (O'Connor, 1994). The turnout gear is designed to withstand the heat of the fire, but it also traps body heat generated by the muscular work being done. The SCBA apparatus worn on their backs places the single most imposing limitation on a firefighters

performance (Gilman & Davis, 1993). As a whole, the fire service has spent millions of dollars over the past 20 years providing better protective equipment for firefighters, resulting in hundreds of lives being saved and preventing numerous injuries. However, this has scarcely put a dent in the leading cause of firefighter fatalities--heart attacks (Hennessey, 1991).

There is little argument against the fact that no matter how well firefighters are protected by their turnout gear, if these same firefighters are not physically fit they stand an above average chance of being injured or killed while on the job (Hennessey, 1991). Research has revealed that the leading cause of firefighter fatalities is heart attack (Fahy, 1993). One way to reduce the risk of heart disease is through occupational and recreational physically exercise (Allison, 1991).

Detailed medical evaluations throughout the course of a firefighter's career and implementation of physical fitness and dietary requirements are necessary to reduce the incidence of heart attacks among firefighters (Hennessey, 1991). Further, numerous experts cite the beneficial effects of exercise as a coping mechanism and release outlet for stress (Facklemann, 1991). Fitness is relevant to the overall success of the department's mission, for without this basic building block, firefighting efforts are seriously

impeded. Ascending levels of fitness correspond directly with increased fire suppression capacity (Davis, 1992). In order to reduce the risk of heart disease, other types of job related injuries, and diminished performance when conducting emergency operations, the topics of health and fitness must be addressed.

During the past 10 years Palm Beach County Fire Rescue has expended the majority of its operating budget on human resources. This is similar to other large metropolitan departments. However, this expenditure does not include any expenses for fitness programs or annual physical examinations.

Palm Beach County Fire Rescue has aggressively implemented a preventive maintenance program for the vehicles and equipment it has purchased during the same 10 year period. Unfortunately, during this period the department has failed to take into account the health and fitness levels of their most valuable resource, their employees. This is evidenced by the fact that the department has not instituted any type of routine fitness programs, mandatory physical examinations, or any specific level of fitness that employees must maintain.

The responsibility for maintaining any degree of fitness at Palm Beach

County Fire Rescue has been left up to the individual employees.

Unfortunately, without a system in place to ensure that this goal is accomplished, and the fact that no fitness standard or annual physicals are required, the employees have not accomplished this task.

Research has revealed that physical demands are especially rigid during work inside a building that is on fire. Moving around inside dwellings that are on fire, while also handling heavy equipment, or carrying injured persons, imposes severe demands on a firefighters respiratory and circulatory organs, and muscular strength (Kilbom, 1980). Firefighters must also have the strength and endurance to use their equipment for long periods of time, along with the ability to recover quickly after each task they perform. This is even more important in this age of reduced departmental staffing.

Responsibility for fitness at Palm Beach County Fire Rescue has been delegated to the employees; however, members of the department are not required to pass any type of annual physical agility test or medical evaluation. Consequently, by delegating this responsibility to departmental employees without assigning accountability, upper management has not committed to a system designed to improve firefighter fitness. Fitness plays a key role in negating the damaging effects of heat, smoke and stress. An increased level

of fitness decreases the chance for serious injury and decreases fatigue, while increasing self esteem and confidence (Bey, 1992). The cost of medical care for injured firefighters, disability payments, lost time at work, and lower quality of work from less fit firefighters can very easily outweigh the cost of developing a fitness program (Bey, 1992).

RECOMMENDATION

A viable solution to the problem facing Palm Beach County Fire Rescue appears to rest in the utilization of the exercise physiologist currently on staff to develop an annual physical agility test and medical evaluation that measures employees' health and fitness levels. Although the implementation of a mandatory annual physical agility test and medical screening may infuriate the labor organization which currently represents the employees, it is a program that is necessary to increase the effectiveness of the employees and decrease the number of job related injuries. As a result, this type of program will heighten job satisfaction, diminish job related stress, and demonstrate fiscal savings.

In order to put together an effective fitness program, Palm Beach County Fire Rescue must do more than purchase exercise equipment to be

placed in the fire stations for the use of employees. If a fitness program is going to be successful, the first step must be marketing the program.

From the fire chief's perspective, there are two parties that need to be sold on the idea of physical fitness. One party is the elected officials that he works for and the other party is the firefighters that he has been hired to lead. After the sale of the idea and funding has been accomplished, successful implementation can begin.

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Appendix A

Copies of Palm Beach County Fire Rescue's 1996/1997 Organizational Chart can be requested directly from Palm Beach County Fire Rescue at (561) 233-

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ORGANIZATIONAL CHART FOR 96/97 BUDGET REQUESTS

Appendix A

